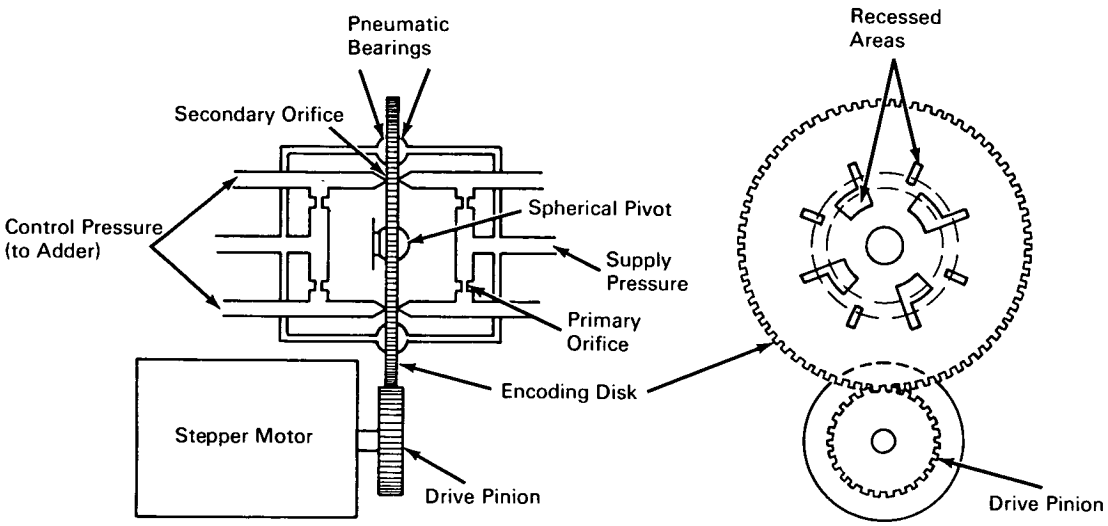
NASA TECH BRIEF

Pneumatic Binary Encoder Replaces Multiple Solenoid System



The problem:

An encoder is required as the pilot stage of a digital actuator. Multiple solenoid systems have been used in the past but they involve much cabling and relatively high power consumption.

The solution:

A pneumatic binary encoder that operates in a flip-flop manner to valve pressurized gas at either a high pressure (600 psi) or low pressure (200 psi).

How it's done:

The pneumatic encoder consists of a stepper motor, encoding disk, and sets of primary and secondary orifices. The encoding disk is mounted on a spherical pivot and rotates between pneumatic bearings to keep frictional torques to a minimum. A stepper motor drives the encoding disk and responds to electrical input pulses to rotate its output shaft through a predetermined angular displacement, e.g. 7.5°, 15°, or 90°, for each pulse received. Rotation of the encoding disk by degrees per input pulse is controlled by selection of drive pinion-to-encoding disk gear ratio. The surface of the encoding disk is recessed in certain areas so that, as the disk is rotated, the secondary orifices are either vented or capped off depending on the angular positions of the recessed areas.

In operation, a supply of gas under pressure is fed to a manifold, on either side of the encoding disk, through sets of primary orifices to sets of secondary orifices that touch the normal suface of the disk as it rotates. In contact with the disk surface, pressure within the secondary orifices holds at its high pressure level of 600 psi. As the disk is rotated by the stepper

(continued overleaf)

motor to a position that indexes a given secondary orifice with a recessed area in the face of the disk, pressure in that orifice drops to its low value of 200 psi. Thus, the flip-flop characteristic of the system is fed in binary form to the adders in accordance with the pulses driving the stepper motor.

Notes:

1. Selection of the proper pinion-to-disk gear ratio provides a large number of discrete angular disk positions so that 6 to 8 adder circuits can be operated from a single disk.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama 35812
   Reference: B66-10374

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Weston Hydraulics, Limited
under contract to
Marshall Space Flight Center
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